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The long term research goal is to devleop a rigorous analytic formulation and, based upon this, a uniform asymptotic description of pulsed electromagnetic beam-field propagation, reflection, and transmission phenomena in causally dispersive dielectric and conducting media. Emphasis has been placed first on a formulation that is regorously derived from the macroscopic Maxwell's equations with constitutive relations that are appropriate for a homogeneous, isotropic, nonhysteretic, locally linear, temporally dispersive medium, followed by the development and application of the required uniform asymptotic expansion techniques necessary to yield a completely continous description of the space-time evolution of the pulsed beam-field at large propagation distances from the input plane.

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The Asymptotic Theory of the Reflection and Transmission of a Pulsed Electromagnetic Beam Field at a Planar Interface Separating Two Dispersive Media

AFOSR Contract No. F49620-92-J-0206

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Our long-term research goal is to develop a rigorous analytic formulation and, based upon this, a uniform asymptotic description of pulsed electromagnetic beam-field propagation, reflection, and transmission phenomena in causally dispersive dielectric and conducting media. Emphasis has been placed first on a formulation that is rigorously derived from the macroscopic Maxwell's equations with constitutive relations that are appropriate for a homogeneous, isotropic, nonhysteretic, locally linear, temporally dispersive medium, followed by the development and application of the required uniform asymptotic expansion techniques necessary to yield a completely continuous description of the space-time evolution of the pulsed beam-field at large propagation distances from the input plane. A detailed description of the most recent results of this research was recently presented in a talk entitled "Asymptotic Description of Electromagnetic Pulse Propagation in a Linear Dispersive Meeting." by the Principal Investigator at the International Conference on Ultra-Wideband, Short Pulse Electromagnetics at the Weber Research Institute (October 1992). A portion of this research resulted in the following publications (reprints attached if currently available):

K.E. Oughstun, "Polarization Properties of the Freely-Propagating Electromagnetic Field of Arbitrary Spatial and Temporal Form," Journal of the Optical Society of America A, 9 (4), 578-584 (1992).

C.M. Balictsis and K.E. Oughstun, "Uniform Asymptotic Description of Ultrashort Gaussian Pulse Propagation in a Causal, Dispersive Dielectric," Physical Review E, 47 (5), 3645-3669 (1993).

K.E. Oughstun, "Reply to Comments on Pulse Propagation in a Linear, Causally Dispersive Medium," Proceedings of the IEEE (to be published).

K.E. Oughstun and G.C. Sherman,"Asymptotic Theory of Pulse Propagation in Absorbing and Dispersive Dielectrics," (Invited Paper), Review of Radio Science, 1990-1992 (Oxford University Press, to be published).

No patents have resulted from this research.